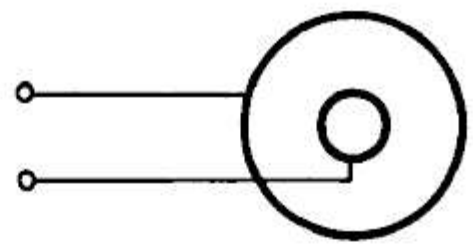

Fig. 1.

a circular disk with one central contact and the other contact in the shape of a circumferential ring (Fig. 1). Because of its greater simplicity the Corbino-disk is probably better suited for constructing a magnetoresistance wattmeter.[3]

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[3] M. J. O. Strutt and S. F. Sun, "Multiphase wattmeters based on the magnetoresistance effect of semiconductors," IRE Trans. on Instrumentation, vol. I-10, pp. 44–49; June, 1961.

Sensitivity of a Magnetoresistance Wattmeter*

In a recent letter[1] S. Kataoka gives the results of some interesting experiments with a magnetoresistance wattmeter. As magnetoresistive element he uses a rectangular slab of semiconductor and he finds that he can increase the magnetoresistance effect by subdividing his slab by metallic strips (Fig. 1 of his letter). By theoretical means he shows that for m metallic strips the sensitivity should increase by a factor $(m+1)$. For large m however he gets considerable deviations from his calculations which he ascribes to practical short-comings. The authors of this note should like to point out that these deviations rather stem from the theoretical derivations. The formula

$$R(B) = R(0)\frac{\rho(B)}{\rho(0)}\left\{1 + \frac{W}{l}\left(\mu B - \frac{4}{\pi}\ln 2\right)\right\}$$

[Kataoka's formula (1) with the same symbols] is given by Lippmann and Kuhrt[2] as an approximation for the rectangle of *small* width to length ratio. If one increases the number of subdividing metallic strips, the width to length ratio of one rectangle gets bigger and this formula no longer holds. Actually it is not possible to increase the magnetoresistance effect of a given material to any desired value, by changing the geometrical form. There is a limit given by the formula

$$R(B) = R(0)\frac{\rho(B)}{\rho(0)}(1 + \mu^2 B^2).$$

This formula holds for a rectangle of infinite width to length ratio and therefore will hold approximately for the rectangular slab subdivided by a great number m of metallic strips. It holds exactly for the Corbino-disk,

* Received October 8, 1962.

[1] S. Kataoka, "Sensitivity of a magnetoresistance wattmeter," Proc. IRE (*Correspondence*), vol. 50, pp. 1849–1850; August, 1962.

[2] H. J. Lippmann and F. Kuhrt, "Der Geometrieeinfluss auf den transversalen magnetischen Widerstandseffekt bei rechteckförmigen Halbleiterplatten," *Z. Naturforsch.*, Band 13a, pp. 462–484; 1958.